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GB 930528
GB 862227
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(54) Packaging particulate material in an inert atmosphere

(57) An apparatus for packaging particulate material in containers (10) includes a vessel(s) (60) which is connectable to an inert gas source (51) and a vacuum source (53) so that particulate material in the vessel(s) (60) can be purged of oxygen by subjecting it firstly to an evacuated environment and thereafter to an inert gas environment, a filling machine (13) which receives the particulate material from the vessel(s) (60) and fills successive containers by evacuating the containers and drawing the particulate material with inert gas from source (51) into the containers, and devices (18, 20) for lidding and hermetically sealing the lids on the containers. The containers may be evacuated and flushed with inert gas before filling.

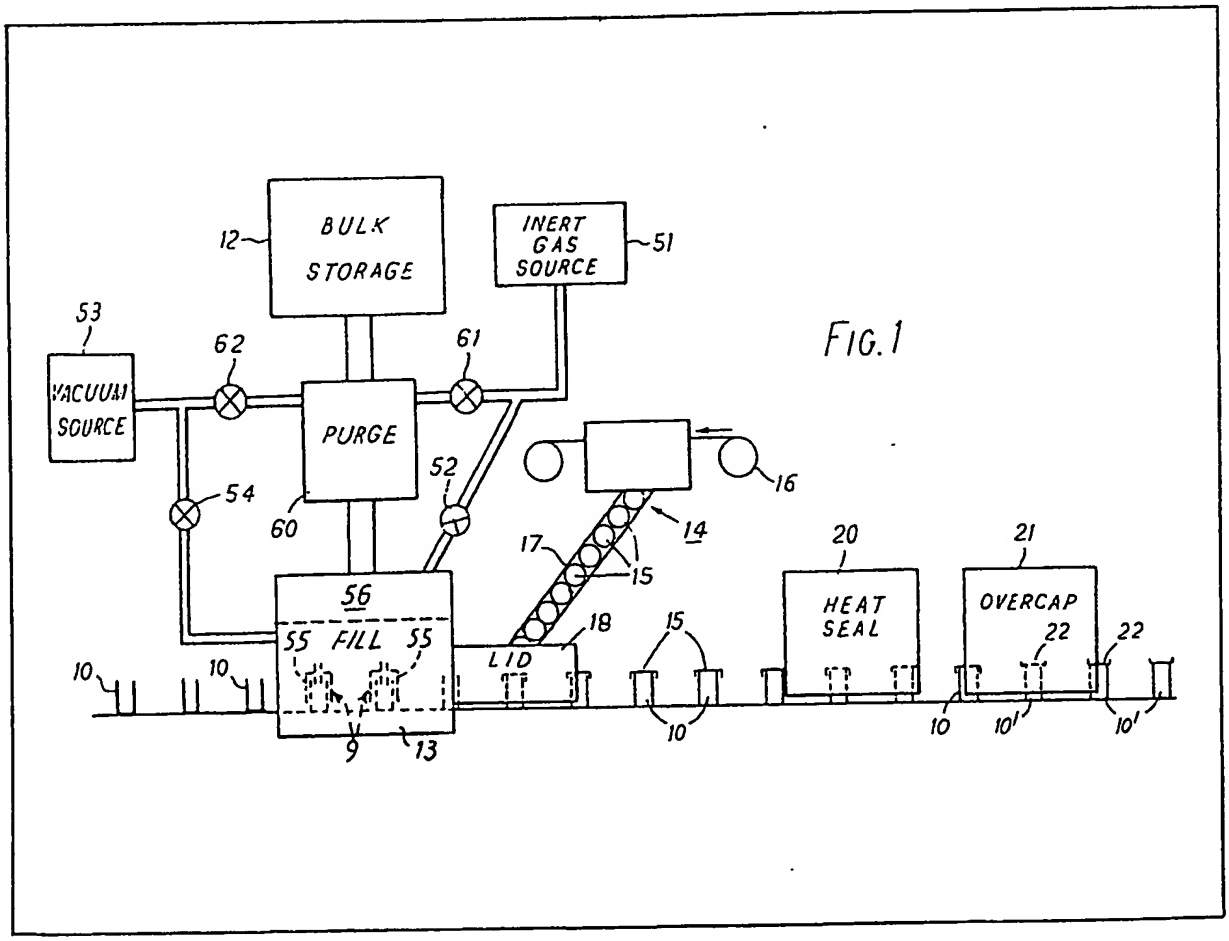

FIG. 1

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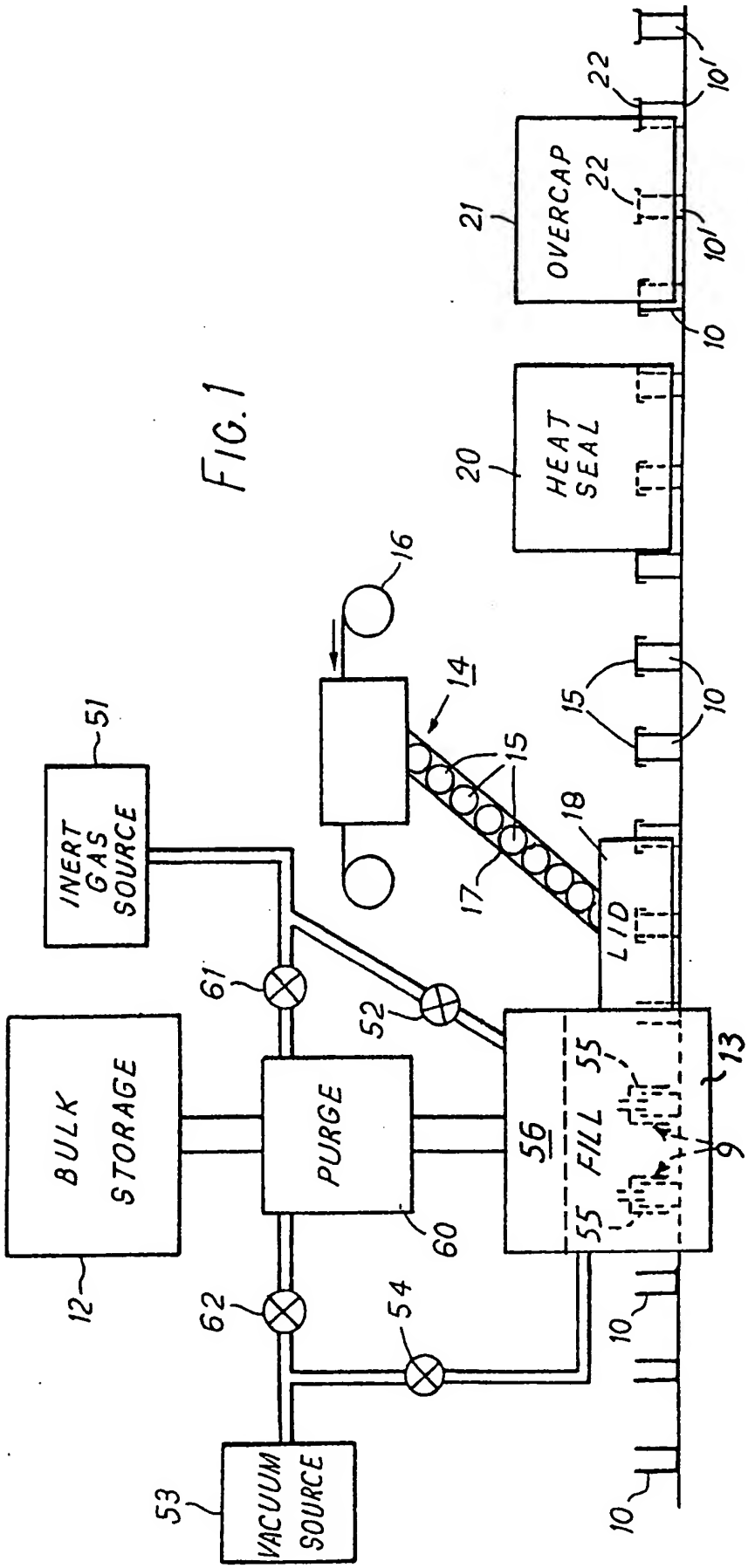
OVERCAP
HEAT SEAL
LID
FILL
PURGE
BULK STORAGE
INERT GAS SOURCE
VACUUM SOURCE
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10'
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FIG. 1

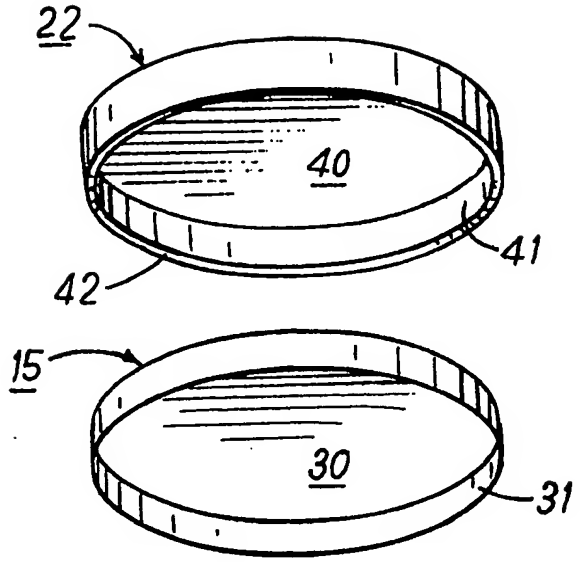
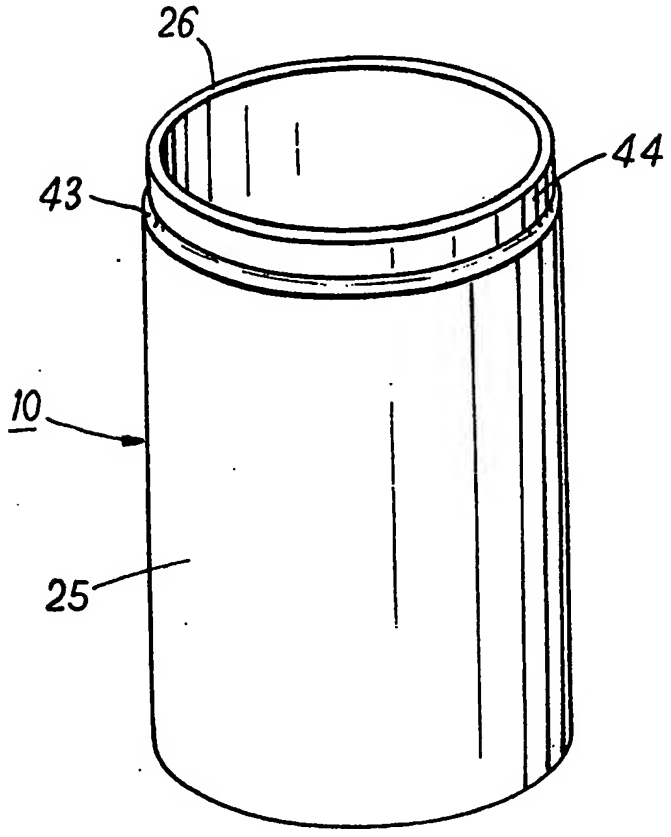
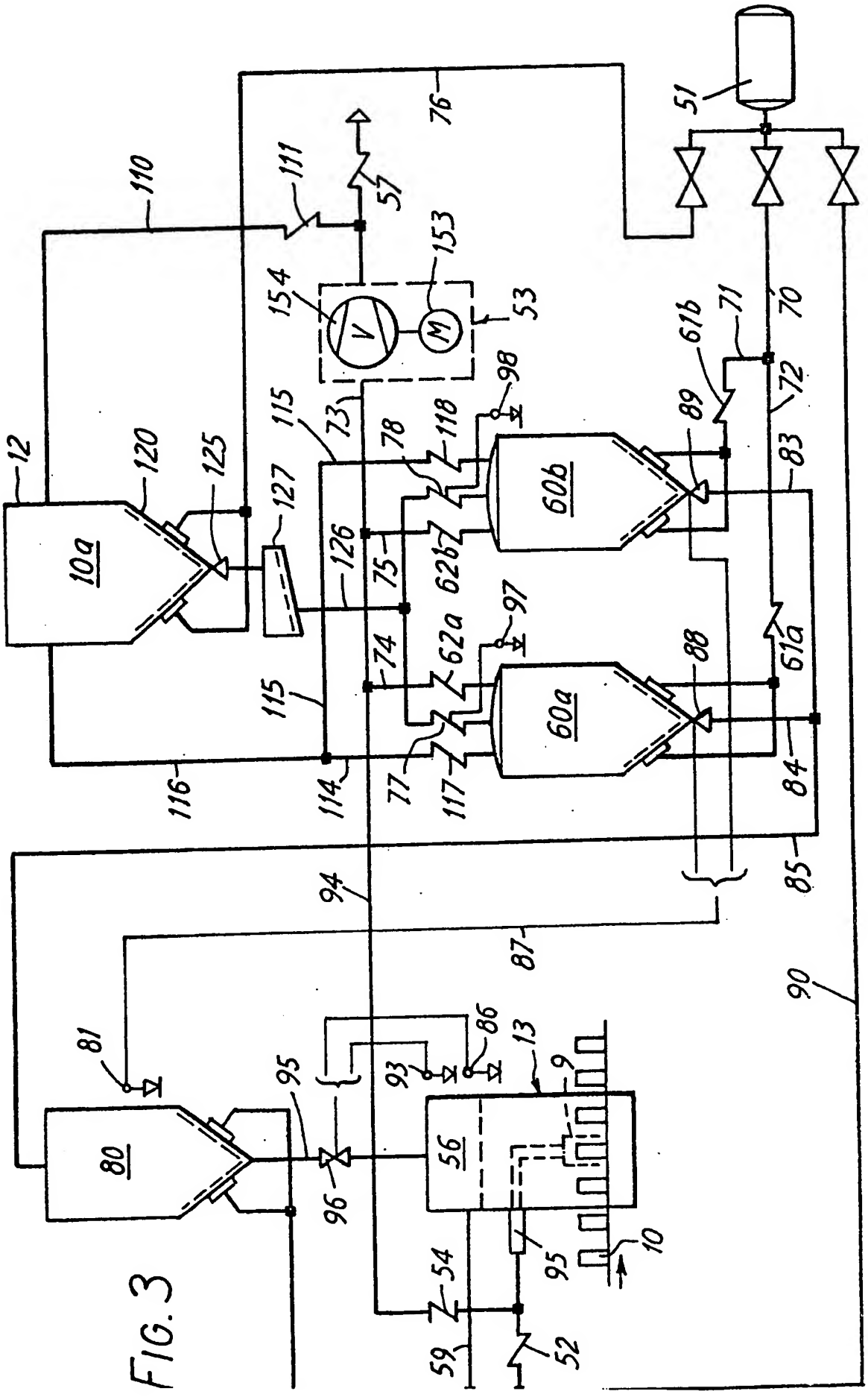


FIG. 2

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111
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78
118
89
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71
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127
126
75
62b
10a
60b
83
97
74
62a
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61a
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94
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93
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96
10
54
95
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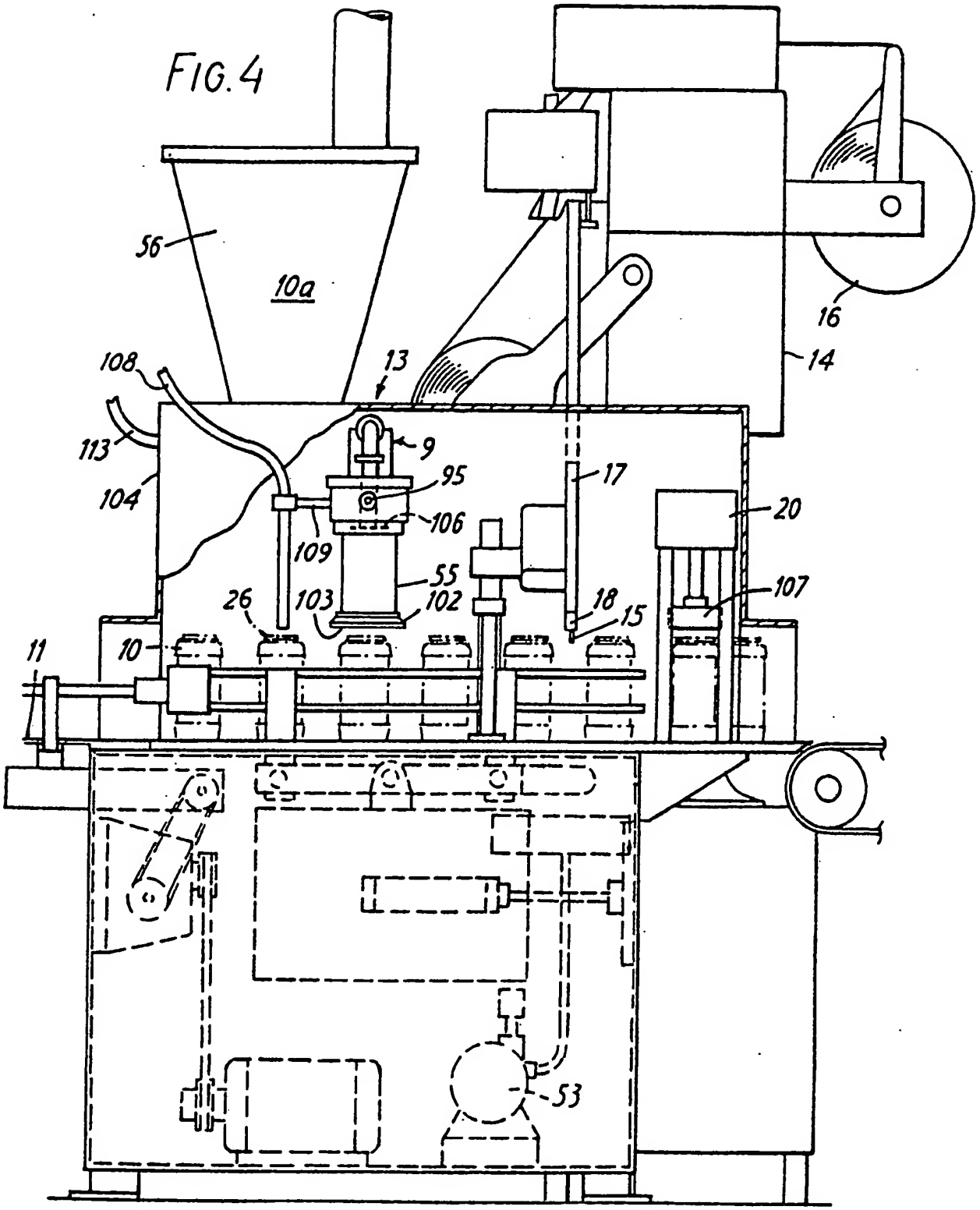
52

FIG. 3

FIG. 4


56
10a
16
14
108
13
113
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95
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104
106
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55
107
26
103
102
18
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11
10
53

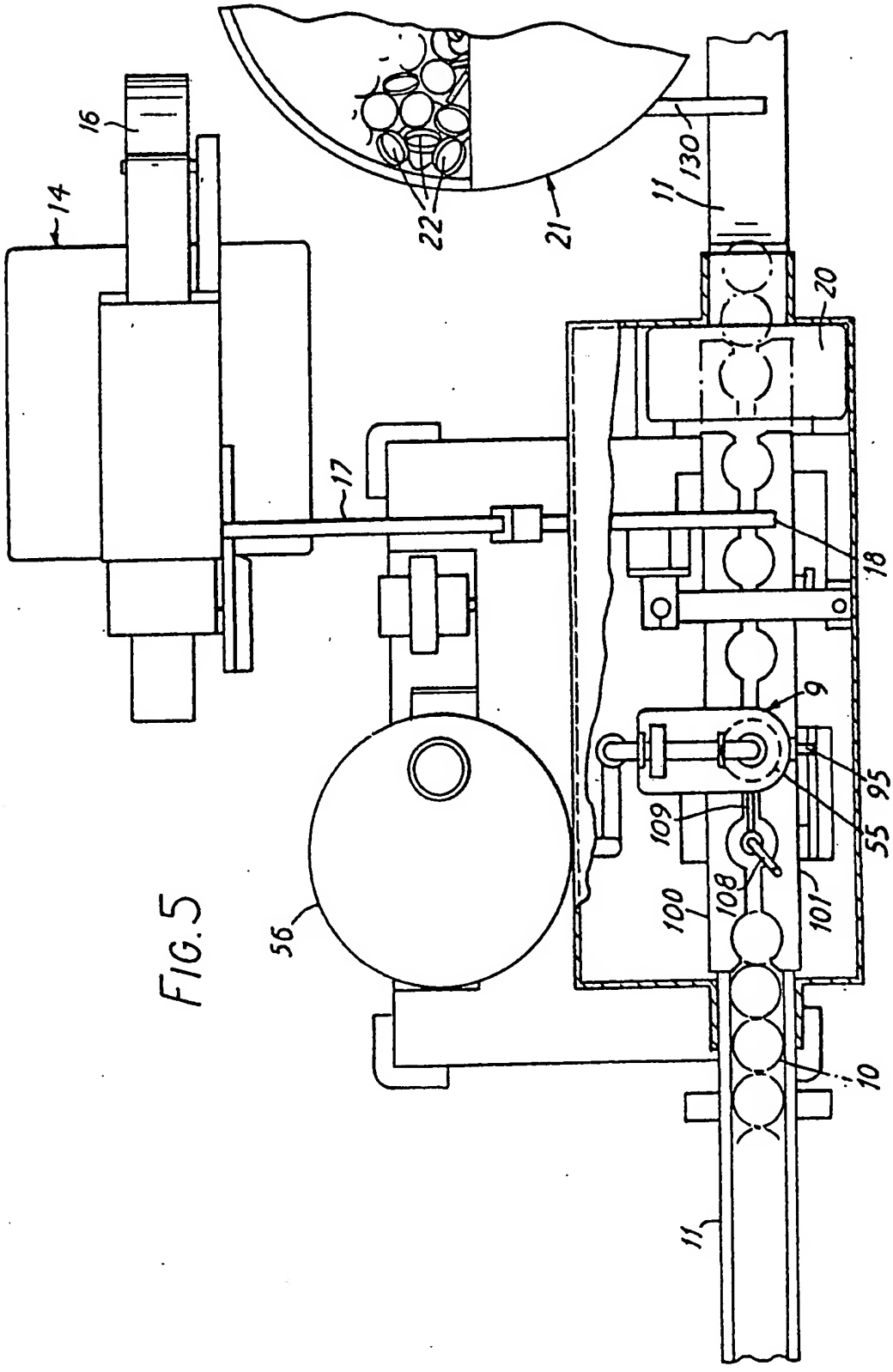


FIG.5

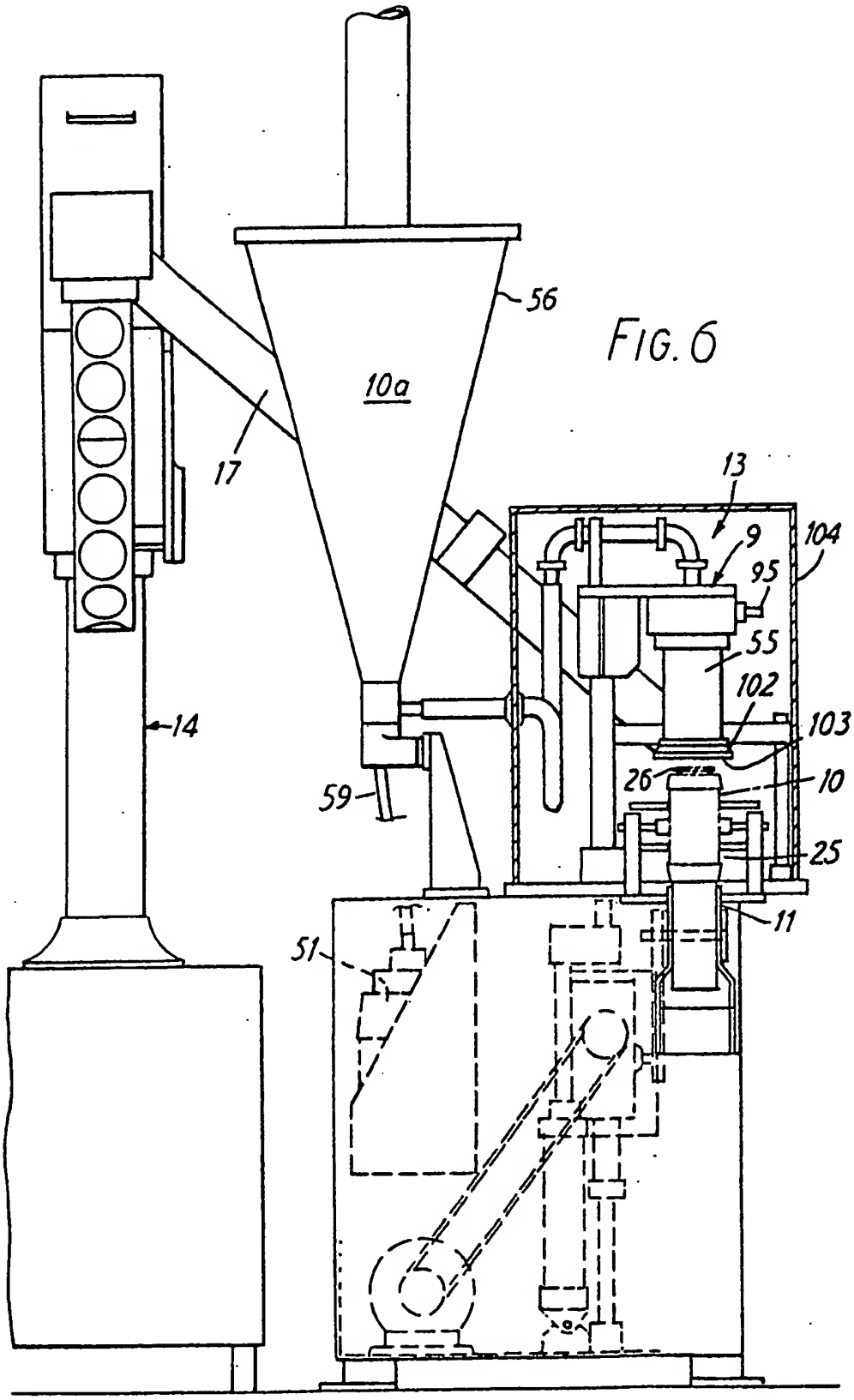
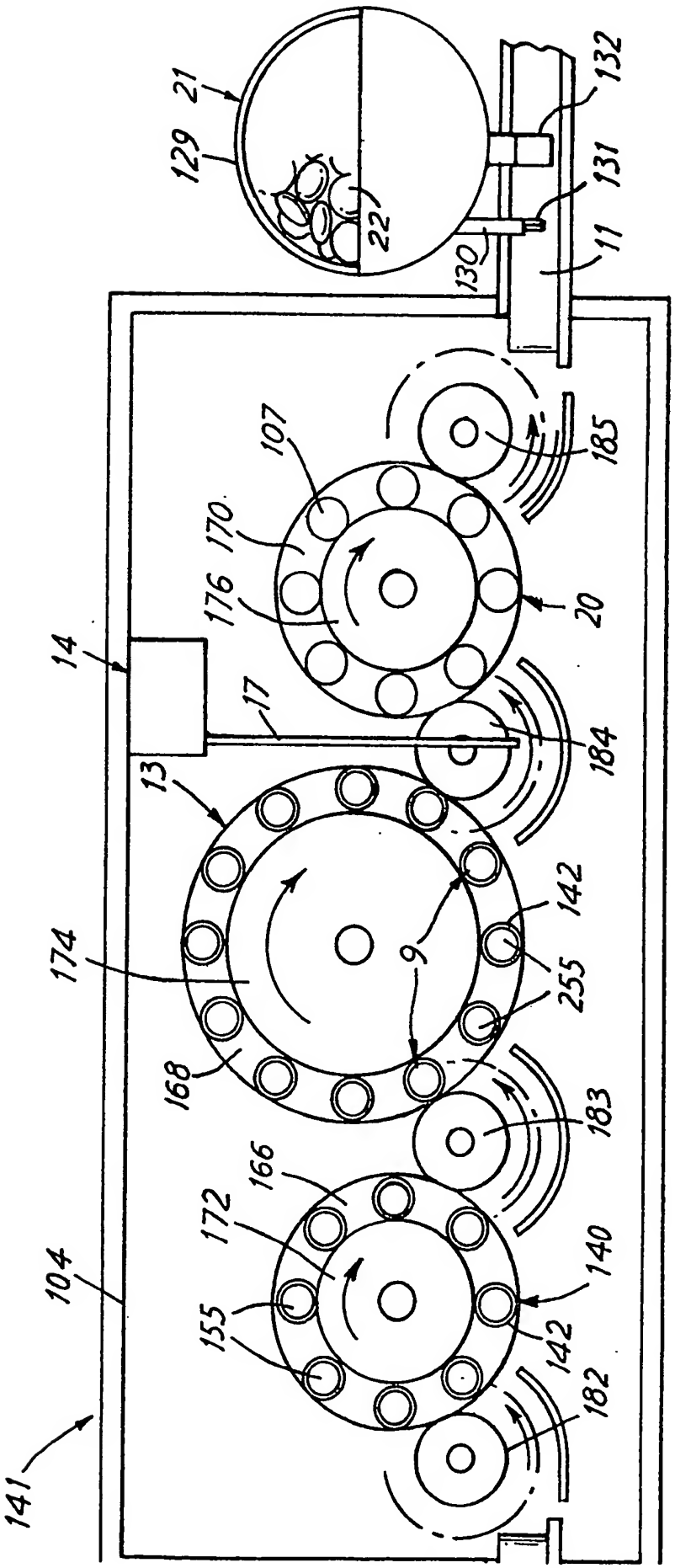


FIG. 6


21
129
22
132
131
11
130
107
185
170
176
20
14
17
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13
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9
142
255
168
183
166
172
104
140
155
142
182
141

FIG. 7

SPECIFICATION
Containers

This invention relates to the gas-packing of rigid or semi-rigid containers with products, particularly (but not exclusively) oxygen-sensitive products such as dried milk powders.

It is already known to pack metal containers with oxygen-sensitive products by a process in which (a) the containers are filled with a metered amount of the product (b) metal closures are placed on the rims defining the container mouths and retained loosely in position by clinching under projections around the container rims, (c) the containers are fed in batches to a gas chamber in which they are evacuated and the partial vacuum broken to an inert gas such as carbon dioxide or nitrogen, and (d) the closures are seamed onto the containers to clse the containers hermetically with the container headspace filled with the inert gas.

Steps (a), (b) and (d) of the above process are carried out on a continuous basis, whereas step (c) is a batch operation. If, for any reason, the containers of a batch emerging from the gas chamber are subject to any substantial delay before seaming, the possibility of oxygen ingress during the delay may render it necessary to repack the cans or scrap them altogether. A further disadvantage of the batch operation of step (c) is that a very substantial area of floor space is required by the gas chamber and its associated marshalling areas.

An alternative to this batch system may be found in U.S. Patent No. 3,135,303 in which powdered product is fed into containers which are then evacuated and gassed. The present system differs from this and all other prior art by combining the steps of (a) substantially purging the product of oxygen by subjecting it firstly to an evacuated environment and latterly to an environment of an inert gas, (b) filling the container with the product by evacuating the container and breaking the partial vacuum to an inert gas so that the container headspace and any interstitial spaces of the product in the container are substantially occupied by inert gas, and (c) hermetically closing the container by a closure adhered and/or mechanically secured in position.

In order to reduce the oxygen content of the product in the container to very low levels (for example, below 2%), it has been found advantageous to precondition the container before its filling with product. This may be achieved in a simple manner by flushing the empty container with an inert gas, but is preferably effected by evacuating the container and breaking to vacuum to an inert gas.

The prior art does disclose pretreatment of a batch of powdered product by evacuation and gas flush. (British Patent No. 1153696). However, in that patent the gas is removed from the package prior to sealing, directly contrary to the present invention. Similarly the prior art discloses evacuation and flushing of a container prior to filling; U.S. Patent Nos. 2066356, 2,761,604, 2023824, 1,679,386, 3,236,023, 2,931,147, 3443352, 2128227, and 2,064,678. These patents all indicate satisfactory purging of the product by this method alone and thus teach away from the present invention.

U.S. Patent No. 3942301 discloses flushing of gas into the product as it is being filled, flushing of the container after filling, preclosing evacuating and sealing of the containers which are flexible bags. The present invention is concerned solely with rigid or semi-rigid containers, and uses both a different method of pretreating the product and flushing of the container prior to filling. Further, 3942301 teaches evacuation of the package after filling and immediately prior to sealing, which is directly contrary to an object of the present invention which is to retain an inert gas atmosphere within the package.

The present invention also provides, according to a second object, an apparatus to perform the process defined above. Furthermore, according to a third aspect, the invention provides a container gas-packed by the said process.

These and other aspects and features of the invention will become apparent from the following description of an apparatus embodying the invention which is now to be described, by way of example, with reference to the accompanying drawings.

In the drawings:—

Fig. 1 schematically shows the apparatus in relation to containers passing along a linear conveyor;

Fig. 2 is an exploded view showing one of the containers and its associated lid and overcap;

Fig. 3 is a schematic diagram of the bulk storage, purging and filling devices generally disclosed in Fig. 1;

Fig. 4 is a side view, partially broken away, of one embodiment of the filling device, lidding device and heat sealer disclosed in Fig. 1;

Fig. 5 is a top view, partially broken away, of the filling device, lidding device and heat sealer of Fig. 4;

Fig. 6 is a front view, partially broken away, of the filling device, lidding device and heater sealer of Figs. 4 and 5; and

Fig. 7 is a schematic diagram of a continuous motion filling device, lidding device and heat sealer alternative to the apparatus of Figs. 4 to 6 but again proposed for use in filling, lidding and sealing of the container of Fig. 2 using the bulk storage, purging and filling devices of Fig. 3.

Referring now to Fig. 1 of the drawings, there is shown an apparatus arranged for gas-packing plastics containers 10 on a continuously-moving linear conveyor 11 with an oxygen-sensitive product such as dried milk powder. The containers enter the apparatus from the left as shown, pass through the apparatus on a generally linear and horizontal path, and leave the apparatus to the right after product-filling, closing and overcapping as will become apparent. The containers are located, by means not shown, at a regular spacing along the conveyor.

The apparatus, which is shown only schematically, comprises a bulk storage silo 12 for the product, a filling machine 13 associated with the conveyor 11 and having one or more filling heads 9 arranged for filling the containers individually with a metered quantity of product, a lidding machine (generally denoted 14) arranged to stamp heat-sealable lids 15 from a reel 16 of plastics coated metal foil, and to pass them onto a gravity-feed chute 17 for automatic (i.e. passive) placement onto the containers by a lid applicator 18 as the containers emerge from the filling machine 13, a heat-sealing machine 20 arranged to apply heat and pressure to the lids so as to heat-seal them to the rims of the containers and thereby hermetically close the containers, and an overcapping machine 21 arranged to fit thermoplastic overcaps 22 onto the containers in overlying relation to the lids 15 so as to give protection to the lids during transit and display and to provide reclosures for the containers at the point of use. The operations of the filler 13, the heat-sealing machine 20 and possibly also the overcapping machine 21 are synchronised with one another and with the movement of the containers along the conveyor. The items 13, 18, 20 and 21 are shown as being arranged in relation to the conveyor so as to operate on the containers as they pass along the conveyor, but it will be appreciated that one or more of these devices, particularly the filler 13 and the heat sealing machine 20, may have their own turntable by which the containers are progressed through the device, and a star wheel or wheels to remove the containers from the conveyor for processing and return them to the conveyor after processing.

After overcapping in the overcapping machine 21, the containers, now denoted 10', leave the apparatus by the conveyor to the right of Fig. 1, for subsequent packing and despatch.

Fig. 2 shows one of the containers 10' and its associated lid 15 (before lidding) and overcap 22. The container 10 itself has a generally cylindrical side wall 25 rising from a base (not visible) and terminating in a rim 26 which defines the container mouth. It may be moulded from any suitable plastics material, laminated or otherwise, which has a desired low oxygen permeability.

The lid has a generally plane and circular closure panel 30, and a peripheral skirt 31 which is primarily provided to enable the lid to be accurately and reliably placed on the container by the applicator 18. The heat-seal between the lid and the container is made largely over a peripheral margin of the closure panel 30, although it may also be made to extend some way down the skirt 31. The plastics coating of the lid material is chosen in relation to the plastics material of the container 10 to which it is required to be heat-sealable. It may be such that the heat-seal is peelable, so that the consumer may tear away the lid for use, or it may be such that heat-seal is effectively unbreakable, in which case the lid is cut or torn to provide access to the container; for that purpose the lid may be scored to define a tear-away panel.

The overcap 22 is injection-moulded from a suitable thermoplastics material such as high density polyethylene. It has a closure panel 40 to overlie the closure panel 30 on the lid 15, and a peripheral skirt 41 to surround the lid skirt 31. The skirt 41 is formed with a continuous, inwardly-projecting bead 42 which is arranged to be removably snap-engaged in a groove 43 formed around the container below the rim 26. Preferably, and as shown, the rim is formed on a reduced-diameter neck 44 of the container, the overcap skirt 41 being dimensioned so that its exterior surface is flush with that of the container side wall 25 when the overcap is fitted; the groove 43 is then located at the base of the container neck.

Reverting again to Fig. 1, the filler 13, lidding machine 14, heat-sealing machine 20 and overcapping machine 21 are individually conventional. In this regard, attached hereto and hereby incorporated by reference, are the following brochures which describe such conventional fillers 13, lidding machines 14, and heat sealing machines 20.

1. "Albro" All British Fillers
2. High speed Albro vacuum operated powder filling machines
3. Albro powder filling machines
4. Capping and Heat Sealing Machines by TI Fords

The filler 13 is arranged to draw a partial vacuum in the containers individually, and to then use the partial vacuum to draw the powder product in metered quantities into the containers. An inert gas (e.g. carbon dioxide, nitrogen or a mixture of these two) is supplied from a source 51 via a control valve 52 to provide the pressure differential required to achieve the product flow into the containers. The partial vacuum itself is generated at a source 53 and communicated through control valve 54. In view of the non-rigid nature of the containers 10, the filling heads 9 of the filler have shrouds 55 which enable the pressures inside and outside each container to be maintained substantially equal throughout the evacuation and filling procedure.

The filler 13 has its own hopper 56 for providing a short-term reservoir of product received from the silo 12. This hopper, which feeds the central filling tubes 105 of the filling heads 9, is topped up on an "on demand" basis from a purging device 60 which may in turn be fed on an "on demand" basis from the silo 12. The device 60 is a closed vessel or series of closed vessels which is or are connectable to the inert gas source 51 and the vacuum source 53 by respective control valves 61 and 62. Product which has entered the device 60 from the silo 12 is subjected to a partial vacuum from the source 53 and then returned to a substantially atmospheric pressure environment by inert gas from the source 51. In this way the product is purged of a substantial proportion of its contained oxygen. Because of this purging operation the oxygen content of the product within each

container is reduced to the low level (e.g. 2%) commensurate with a long shelf life for the product in the completed container 10'.

The lidding machine 14 is coupled to the filler 13 so that little or no oxygen can enter the containers before lids 15 are applied. The lids then prevent any substantial oxygen ingress before the containers are hermetically closed by the heat-sealing machine 20. If desired, the lids may be applied when the containers are subject to a small sub-atmospheric or super-atmospheric pressure of inert gas so as during movement of the container to the heat-sealing machine either to affect a temporary seal between lid and container, or to ensure that gas is vented from the container rather than drawn into it. A hood filled with inert gas may be provided to cover the containers as they pass between the lid applicator 18 and the heat-sealing machine 20; alternatively or additionally a drop of liquid nitrogen may be placed in each container between filling and lidding.

For performing its purging action on the product passing to the filler 13 the purging device 60 may either be arranged to operate on a continuous cycle within the "on demand" control exercised by the filler; alternatively it may be arranged to process the product in batches within one or more chambers, and to pass the processed batches of product to a reservoir from which the "on demand" requirement of the filler is met. During purging the product may be mechanically disturbed so that each grain of the powder is properly subjected to the partial vacuum and latterly the inert gas.

In a modification of the described arrangement the lidding machine 14 and the heat-sealing machine 20 are replaced by a diaphragming machine which presents a heat-sealable foil to each container in turn, heat-seals the foil to the container rim as a diaphragm forming an hermetic seal for the container, and then severs the diaphragm from the parent foil around the container rim.

Although particularly described in relation to the gas-filling of non-rigid plastics containers with dried milk, the invention is not to be considered as limited to such an application. The containers in relation to which the invention may be used may be rigid or non-rigid, of plastics, glass, metal, board or a combination of these, and closed by any suitable type of closure whether adhered or mechanically attached in position; in addition, the invention may be used with oxygen-sensitive products other than dried milk powder.

Greater detail of the aforementioned process and apparatus for storing, purging and product filling may be seen in Fig. 3 of the drawings. Powdered product 10*a* is stored in bulk storage silo 12 at atmospheric pressure. It is dispensed by means of gravity feed through a conventional cut off valve 125 and through pipe 126 with sifter 127 to purging devices 60*a* and 60*b*.

Sifter 127 is of conventional design and arranged to prevent any lumps of product, foreign matter, etc from entering the purging devices 60*a* and 60*b*.

Purging devices 60*a* and 60*b* are closed pressure vessels which are connected by means of pipes 70, 71 and 72 to a source 51 of nitrogen under pressure. Purging devices 60*a* and 60*b* are also connected by means of pipes 73, 74 and 75 to a vacuum source 53 comprising a vacuum pump 154 and associated driving motor 153. Optionally, storage silo 12 may also be connected to inert gas source 51 by means of pipe 76 to provide a fluidising layer of nitrogen down the inner face of the silo cone 120 to assist product discharge. Pump 154 is arranged to vent the atmosphere via a valve 57.

In order to pretreat powdered product 10*a* with inert gas, so as to drive off substantially all the oxygen present, powdered product 10*a* is flushed with inert gas in purging devices 60*a* and 60*b*. Powdered product 10*a* is dispensed by means of normally open valve 125 through pipe 126 and sifter 127 into purging devices 60*a* and 60*b* which are then closed by means of valves 77 and 78 operating in response to respective high level sensors 97 and 98. Once closed a vacuum is drawn on the purging devices by means of vacuum source 53 acting through pipes 73, 74 and 75. Vacuum is controlled by valves 62*a* and 62*b*. The vacuum is broken by the introduction of inert gas from inert gas source 51 through pipes 70, 71 and 72. Flow of inert gas in controlled by valves 61*a* and 61*b*.

In a preferred embodiment purging devices 60*a* and 60*b* each hold roughly 2 to 3 tons of powdered product. Vacuum is applied to roughly 20 inches of mercury negative pressure. The preferred inert gas, nitrogen, is introduced until pressure vessels 60*a* and 60*b* are pressurized to atmospheric pressure or slightly above it. Advantageously, and as indicated, the nitrogen incoming into the purging devices is arranged to form a fluidising layer in the manner of the supply of nitrogen to the silo 12 through pipe 76.

Following the purging by nitrogen gas, powdered product 10*a* is selectively piped from either purging device 60*a* or 60*b* through pipes 83, 84 and 85 into a reservoir 80 which is a closed vessel having a capacity somewhat greater than that of each purging device 60*a* and 60*b*. The reservoir is connected to inert gas source 51 by pipe 90 so as at all times to have a nitrogen atmosphere approximately at atmospheric pressure. A low level sensor 81 detects when the reservoir 80 is able to receive the capacity of one of the purging devices 60*a* or 60*b*. An electrical signal is then sent through circuit 87 to one or the other of electrically activated disc valves 88 and 89; the selected valve then opens, allowing the whole contents of its associated purging device to discharge into the reservoir 80. Means are provided to ensure that such discharge cannot take place unless the contents of the purging device have been subjected to an evacuation and purging cycle as described above. After discharge the respective valve 88 or 89 is closed, and valve 77 or 78 is opened so as to charge the purging

device with product for the next evacuating and purging cycle.

In general, the purging devices 60*a* and 60*b* will be controlled to operate in counterphase, so that one device is discharging and filling while the other device is performing its evacuating and purging cycle.

The outlet of the reservoir 80 is connected by pipe 95 to the product inlet of the filler hopper 56. A valve 96 is provided in pipe 95 to control product flow in response to low and high level sensors 86, 93 associated with the filler hopper. Hopper 56 is connected to inert gas source 51 by pipe 59 so as to be at atmosphere pressure.

One embodiment of conveyor 11, filling machine 13 with filling head 9, lid applicator 18 and heat sealing machine 20 may be seen in greater detail in Figs. 4 to 6. As seen in Fig. 4, container 10 is brought towards filling head 9 within hood 104 by means of continuously moving conveyor 11. Hood 104 is supplied with nitrogen at slightly above atmospheric pressure through pipe 113. Conveyor 11 advances the containers to intermittently moving gripper bars 100 and 101 (Fig. 5), which are laterally disposed on each side of the container path. Gripper bars 100 and 101 move in a generally rectangular motion towards each other so as to grip the containers and advance them along the path. As they separate, the containers are left stationary until the next cycle. Each container 10 in turn is thereby positioned under filling head 9. Filling head 9 has a metal shroud 55 with a circular rubber sealing gasket 102 disposed about its base 103. It also has a central filling tube 105 connected to the outlet of the filler hopper 56 and arranged to discharge product through a central aperture in mesh screen 106. Filling head 9 is lowered to over each container to bring the shroud 55 in enclosing relation with the container with its gasket 102 sealing around the container base; movement of the filling head 9 also enters the filling tube 105 with screen 106 into the container mouth. A vacuum is then drawn within the shroud by actuation of valve 54 (Fig. 3) in pipe 94 by which gas conduit 95 to filling head 9 is connected with the vacuum source 53.

The filler head 9 is connected directly to the hopper 56 for product flow therebetween, so that the reduced pressure created in the container causes the inert gas in the hopper to drive product into the container. Container 10 then fills until a predetermined quantity of the product 10*a* has entered, at which time the product reaches the screen 106 which thereby cuts off the flow of product. After filling, the vacuum in the gas conduit 95 and filler head 9 (including the headspace of the container) is broken to nitrogen at atmospheric pressure by operation of valve 52 associated with the line 90. Thereafter, container 10 is lidded and sealed by a conventional lidder 14 and sealing machine 20 such as those manufactured by T.I. Fords, Bedford, England.

In the lidder, lids 15 are stamped from a reel 16 of plastics coated metal foil. The lids are passed onto gravity feed chute 17 and individually hung over the container path so as to be picked off by a container 10 and fall loosely into closure forming position onto the container rim 26. Heat sealer 20 thereafter applies approximately 190°F for 1.5 seconds, with sufficient pressure to seal lid 15 to rim 26. This is accomplished by means of a heated sealing head 107 which is forced downward onto rim 26. Following sealing the head 107 is raised, and the container 10 continues along the path through the apparatus to a continuation of the conveyor 11.

A particular and advantageous feature of the apparatus is the provision of a means for pretreating the containers before they are filled with product. As shown, this may take the form of a pipe 108 which is connected to the inert gas source 51 and which is supported from filling head 9 by bracket 109 so that when the filling head is lowered onto a container 10 it enters the open mouth of the succeeding container. The nitrogen thereby caused to enter the succeeding container displaces a substantial proportion of the air from the container so as to precondition the container for the filling operation which follows.

The hood 104 covers the container at all times from its preconditioning by nitrogen from the pipe 108 to its eventual sealing by the sealing machine 20. The oxygen content of the sealed container 10 is thereby held to a level below 2% on average.

An additional feature of the present system is the reduction in the amount of inert gas (i.e. nitrogen) required to maintain the container 10 at such a low level of oxygen content. In this regard, and as shown in Fig. 3 of the drawings, a pipe 110 including a valve 111 leads from the exhaust or outlet of vaccum source 53 to the bulk storage silo 12. When the purging devices 60*a* and 60*b* are being evacuated as described above, the valve 111 is opened (and the valve 57 closed), so that the nitrogen-rich gas left in the purging devices by their previous purging operation is recycled to the product in the silo 12. In this way a substantial proportion of the oxygen in the product in silo 12 will be displaced.

Further pipes 114, 115 and 116 with valves 117, 118 lead directly from the purging devices 60*a*, 60*b* to the silo 12 so as to bypass the vacuum source 53. These pipes are therefore operative to recirculate gas from the purging devices to the silo 12 during the time that the pressure in the purging devices is superatmospheric and the valves 117, 118 are open.

As best seen in Fig. 8 of the drawings, in a preferred embodiment of the invention, filling machine 13, lidding machine 14 and heat sealing machine 20 are combined with a container preconditioning device 140 in a unitary and compact mono-block system 141 for which a hood 104 of simple design and construction can be provided.

The preconditioning device 140, machine 13 and sealing machine 20 are rotary machines each having a turntable with lifting platforms 142 and

associated actuators (not shown) arranged around its periphery, and a carousel with heads for co-operation with the containers when lifted by respective ones of the lifting platforms. The turntable and the carousel rotate continuously in synchronism. In Fig. 7 the turntables of the devices 140, 13 and 30 are respectively denoted by the reference numerals 166, 168 and 170, and their carousels by the reference numerals 172, 174 and 176.

Starwheels 182, 183, 184 and 185 link the devices 140, 13 and 20 operatively together and with the incoming and outgoing portions of the linear conveyor 11, so that the containers may move continuously through the apparatus at a predetermined spacing, being preconditioned, filled and closed as they pass through the devices 140, 13 and 20 respectively. Container preconditioning device 140 and filling machine 13 each comprise a series of metal shrouds 155, 255 respectively which are substantially identical in construction to the shrouds 55 shown in Figs. 4 to 6 but mounted on circular carousels 172 and 174. At the device 140 each container 10 is lifted into a metal shroud 155 so that the shroud forms an enclosure with the lifting platform under the container. A vacuum is drawn in each enclosure in turn so as to evacuate the container therein, after which the vacuum is broken by introduction of nitrogen which fills the container to atmospheric pressure. In the manner described in relation to the previous embodiment, both the drawing of the vacuum and the introduction of the inert gas are performed through a single conduit (not shown) connecting each metal shroud to the inert gas source 53 and to the vacuum source 51. As before, evacuation and gassing are both controlled by conventional gas valves and electric switching devices.

Following the preconditioning of a container 10 the associated lifting platform 142 is lowered, and the container passes from the turntable 166 and moves via the starwheel 183 onto the turntable 168 of the filling machine 13. The filling machine is a rotary vacuum filler having shrouds 255 of filling heads 9 into which the containers 10 are lifted as the machine rotates, and a vacuum is drawn in the containers. The filling heads are individually as described in relation to the filling head 8 of Figs. 4 to 6. Accordingly, the shrouds 255 have screens 106 as described in relation to Figs. 3 and 4. Thus, when each container is full with product up to the level of its associated screen, product flow is halted whereafter the vacuum in the container headspace is broken by introduction of nitrogen from the inert gas source 51 through the same gas conduit as served for the earlier evacuation of the container.

After lowering on its associated lifting platform 142 by the respective actuator, container 10 then passes from turntable 168 to turntable 170 by means of starwheel 184. As it moves around the starwheel 184, lidding machine 14 loosely applies a lid to the container precisely as described in relation to Figs. 4 to 6. The lidded container 10 then passes to heat sealing machine 20. A series of heated sealing heads 107 are positioned around carousel 176 so as each to engage a lidded container lifted against it by the lifting platform on which the container is located. The heat and pressure which are thereby applied to the lid seal it hermetically onto the rom 26 of the container as described in relation to Figs. 4 to 6. Following sealing the container is lowered and the sealed container 10' is moved by starwheel 185 out of the hood 104 and back onto linear conveyor 11.

Disposed adjacent to conveyor 11 is overcapping machine 21 which aligns a plurality of overcaps 22 in a circular rotating hopper 129 and passes them individually, after orientation, down a chute 130 having a release mechanism 131 which holds each overcap in turn so as to overhang the end of the chute. Rim 26 of container 10 thereby catches the downwardly hanging overcap and pulls it through the release mechanism 131. Roller 132 then engages overcap 22 fully on rim 26 so that it is fixedly attached thereto. It has also been found that attachment of overcap 22 tends to crimp peripheral skirt 31 of lid 15 about rim 26.

CLAIMS

1. A method of gas-packing a container with a flowable product, which comprises, in combination, the steps of:

(a) substantially purging the product of oxygen by subjecting it firstly to an evacuated environment and latterly to an environment of an inert gas;

(b) filling the container with the product by evacuating the container and breaking to partial vacuum to an inert gas; and

(c) hermetically closing the container by a closure.

2. A method of gas-packing a container with a particulate product, which comprises, in combination, the steps of:

(a) holding the product in a bulk storage means;

(b) moving the product from the bulk storage means to a purging means:

(c) substantially purging the product of oxygen by subjecting it, when disposed in said purging means, firstly to a partial vacuum and latterly to an inert gas;

(d) moving the proudct from the purging means to a filling means for the container;

(e) filling the container with the product by evacuating the container and breaking the partial vacuum to an inert gas so that the container headspace and any intersticial spaces of the product in the container are substantially occupied by inert gas; and

(f) hermetically closing the container by a closure.

3. A method of gas-packing a rigid or semi-rigid container with a particulate product, which comprises, in combination, the steps of:

(a) holding the product in a bulk storage means;

(b) moving the product in batches from the bulk

storage means to a purging means;

(c) substantially purging each batch of the product of oxygen in turn by subjecting it, when disposed in said purging means, firstly to a partial vacuum and latterly to an inert gas;

(d) moving the product from the purging means to a filling means for the container;

(e) filling the container with the product by evacuating the container and breaking the partial vacuum to an inert gas so that the container headspace and any intersticial spaces of the product in the container are substantially occupied by inert gas at atmospheric pressure; and

(f) hermetically closing the container by a closure.

4. The method as defined in Claim 1, which includes the further steps of preconditioning the container before product filling by at least flushing the container with an inert gas.

5. The method as defined in Claim 4, wherein the container is preconditioned by subjecting it firstly to an evacuated environment and latterly to an environment of an inert gas.

6. A method as defined in Claim 1, which includes the further step of applying an overcap to the container in overlying relation to the said closure, the overcap providing a reclosure for the container in use.

7. An apparatus for gas-packing containers with a flowable product, which comprises:

(a) a product filling station;

(b) storage means to supply said flowable product;

(c) vacuum means;

(d) inert gas supply means;

(e) means interconnecting said vacuum means and said inert gas supply means with both said product filling station and said conduit means;

(f) a closure application station; and

(g) conveyor means to transport said containers through said filling and closure application stations.

8. An apparatus for gas-packing containers with a flowable product, which comprises:

(a) a product filling station;

(b) storage means to supply said flowable product;

(c) conduit means extending between said storage means and said product filling station;

(d) purging means of said conduit means;

(e) vacuum means;

(f) inert gas supply means;

(g) means interconnecting said vacuum means and said inert gas supply means with both said product filling station and said purging means of said conduit means;

(h) a closure application station; and

(I) conveyor means to transport said containers through said filling and closure application stations.

9. The apparatus as defined in Claim 7, further including a heat sealing station positioned downstream of said closure application station with said conveyor means extending thereto.

10. The apparatus as defined in Claim 9, further including an overcap station positioned downstream of said sealing station with said conveyor means extending thereto.

11. The apparatus as defined in Claim 1, wherein said storage means includes a storage silo positioned above said filling station.

12. The apparatus as defined in Claim 7, further including at least one purging device in said conduit means, said vacuum means and said inert gas supply means being connected with said purging device.

13. The apparatus as defined in Claim 12, wherein said purging device includes means to operate on either a continuous or batch cycle.

14. The apparatus as defined in Claim 13, wherein said filling station further includes at least one filling head with a shroud for surrounding a said container during filling.

15. The apparatus as defined in Claim 9, wherein said closure application station includes means to continually apply metal foil closures to said containers.

16. The apparatus as defined in Claim 15, wherein said lid application station further includes means to continually stamp said foil closures from a reel of metal foil and continually position said closures on said containers.

17. The apparatus as defined in Claim 16, wherein said closure application station further includes a gravity feed chute for transporting said stamped foil closures from said stamping means, said closure application station and said product filling station have a common enclosure, means are provided to introduce an inert gas into said enclosure, and said chute extends through said enclosure.

18. The application as defined in Claim 17, wherein said enclosure extends to said heat sealing station.

19. The apparatus as defined in Claim 7, wherein said storage means is specifically designed to accommodate a powdered food product and said conveyor means is specifically adapted to transport plastic containers.

20. The apparatus as defined in Claim 7, which further includes a preconditioning station for preconditioning the containers as they pass along the conveyor means to the product filling station, the preconditioning means including means to introduce inert gas into said containers so as at least to flush the containers with inert gas.

21. The apparatus as defined in Claim 20, wherein said preconditioning station is connected with said vacuum means and said inert gas supply means, and has means for evacuating said containers and breaking the partial vacuum to said inert gas.

22. The apparatus as defined in Claim 21, wherein said preconditioning and product filling stations each comprise a turntable and associated carousel arranged to rotate in synchronism, the stations being connected in serial relation for said containers to pass therethrough, and comprising respective groups of heads engageable with the containers to effect preconditioning and product

filling of the containers.

23. An apparatus for gas-packing containers with a flowable product, which comprises:

(a) a storage means to supply said product;

(b) a purging device for said product;

(c) a vacuum filling station for filling said containers with said product by a partial vacuum;

(d) conduit means interconnecting said storage means, purging device and vacuum filling station for product flow therebetween;

(e) a container preconditioning station;

(f) a closure application station for said containers;

(g) vacuum means;

(h) inert gas supply means;

(i) conveyor means to transport said containers sequentially through said preconditioning station, vacuum filling station, and closure application station; and

(j) means interconnecting said vacuum means and said inert gas supply means with each of said purging device, container preconditioning station and vacuum filling station and arranged to subject the product or containers, when located in such device or station, firstly to a partial pressure from said vacuum means and latterly to inert gas from said gas supply means.

24. An apparatus as defined in Claim 23 for said containers of thermoplastics material, wherein the closure application station includes stamping means for stamping closures from plastics coated metal foil material, and applicator means for applying the closures to said containers, the apparatus further including heat-sealing means to heat-seal the closures to the containers.

25. The apparatus as defined in Claim 24, wherein the heat-sealing means comprises a heat-sealing station to which the conveyor means extend beyond the lid applicator station.

26. A method of gas-packing a container, substantially as hereinbefore described with reference to Fig. 1 of the accompanying drawings.

27. Apparatus for gas-packing a container, substantially as hereinbefore described with reference to Figs. 3 to 6 of the accompanying drawings.

28. Apparatus for gas-packing a container substantially as hereinbefore described with reference to Figs. 3 and 7 of the accompanying drawings.

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